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A.D. 1870, 6th MAY. N° 1299.

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S P E C I F I C A T I O N

OF

DAVID WALKER.

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PREVENTING SMOKE IN FURNACES.

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L O N D O N :

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1870.







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A.D. 1870, 6th May. N° 1299.

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**Preventing Smoke in Furnaces.**

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**LETTERS PATENT** to David Walker, of Leith, in the County of Mid Lothian, North Britain, Engineer, for the Invention of “**IMPROVEMENTS IN APPARATUS OR ARRANGEMENTS FOR PREVENTING OR REDUCING THE PRODUCTION OF SMOKE IN FURNACES.**”

Sealed the 1st November 1870, and dated the 6th May 1870.

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**PROVISIONAL SPECIFICATION** left by the said David Walker at the Office of the Commissioners of Patents, with his Petition, on the 6th May 1870.

I, DAVID WALKER, of Leith, in the County of Mid Lothian, North  
5 Britain, Engineer, do hereby declare the nature of the said Invention for  
“**IMPROVEMENTS IN APPARATUS OR ARRANGEMENTS FOR PREVENTING OR REDUCING  
THE PRODUCTION OF SMOKE IN FURNACES,**” to be as follows, that is to say:—

This Invention has for its object to prevent or reduce the production  
of smoke in furnaces, and it consists in causing air to traverse piping  
10 placed in the flue or flues leading from the furnace, and then to issue  
amongst and mingle with the fire gases at the back of the furnace. The  
air is made to traverse the piping in the flues by means of a fan or other  
blowing apparatus, and when the furnace or the furnace and steam  
boiler or other apparatus heated by it are situated in a shed, building, or



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other enclosure so that the air over and about them is heated by radiation, the blowing apparatus is arranged to take up such heated air and force it through the piping. A double or broad bridge is constructed at the back of the furnace, and the piping leads the heated air into a space formed in the lower part of this bridge. One or more narrow slits or 5 openings in the top of the bridge allow the air to issue from the space below and it mingles with the fire gases as they pass over the bridge and insures the thorough combustion of any incompletely burnt portions, the space over the bridge being contracted so as to compel a thorough intermingling of the air and gases. With the described arrangements a 10 sufficient quantity of air can be blown in to suit any condition of the furnace, but whilst in many attempts hitherto to prevent smoke by the introduction of air amongst the fire gases the object has been defeated by the deficiency of heat in the air so introduced, such deficiency is prevented according to the present Invention by the very efficient mode 15 of heating the air by placing the air piping in the flues, which piping may be made to traverse the flues to any extent that may be found requisite or advantageous in practice. It may however be stated by way of example that in an internally fired steam boiler of moderate dimensions, it has been found quite sufficient to introduce an air pipe into the 20 first flue at the back end of the boiler, and to lead it directly along the bottom of the internal flue forward to the bridge at the inner end of the furnace.

One fan or piece of blowing apparatus may be used to supply air to two or more furnaces, each branch pipe being fitted with a valve or 25 damper to regulate the supply by it.

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**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said David Walker in the Great Seal Patent Office on the 4th November 1870.

**TO ALL TO WHOM THESE PRESENTS SHALL COME, I, DAVID 30 WALKER, of Leith, in the County of Mid Lothian, North Britain, Engineer, send greeting.**

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Sixth day of May, in the year of our Lord One thousand eight hundred and seventy, in the thirty-fourth 35



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year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said David Walker, Her special licence that I, the said David Walker, my executors, administrators, and assigns, or such others as I, the said David Walker, my executors, administrators, and  
5 assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for “IMPROVEMENTS IN APPARATUS OR ARRANGEMENTS FOR  
10 PREVENTING OR REDUCING THE PRODUCTION OF SMOKE IN FURNACES,” upon the condition (amongst others) that I, the said David Walker, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to  
15 be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said David Walker, do hereby declare the nature of my said Invention, and in what manner the same is to be  
20 performed, to be particularly described and ascertained in and by the following statement in writing, reference being had to the accompanying Drawings, that is to say :—

My said Invention has for its object to prevent or reduce the production of smoke in furnaces, and it consists in causing air to  
25 traverse piping in the flue leading immediately from the furnace and then to issue amongst and mingle with the fire gases at the back or inner end of the furnace. Numerous plans have been tried for reducing or preventing smoke in which air has been introduced amongst the fire gases at the inner end of the furnace, and in many of these plans  
30 the desirability of heating the air so introduced has been recognised, but such heating has been effected by what is termed “waste” heat, that is to say, either by the comparatively cool fire gases after they have traversed the flues through or in contact with the boiler or object which the furnace has to heat, or by heat unavoidably radiated through the  
35 outer walls of the flues. I, however, consider that air so heated by mere “waste” heat as referred to, cannot be thereby sufficiently heated for effecting the desired object of preventing smoke in the best and most certain manner, and so as to economise coal, as any efficient smoke



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preventing arrangement ought to do. Therefore by my present Invention I ensure a thorough heating of the air to be introduced for perfecting the combustion of the fuel gases by placing the air pipes or ducts in the hottest part of the flues, and whilst it might seem at first sight that to do so must cause the abstraction of heat (by the air) from the fire gases 5 before those gases have done all their possible duty upon the boiler or other object, it must on the other hand be observed that such abstraction of heat does not in reality occasion loss as it is wholly returned with the air into the same flues.

And in order that my said Invention and the manner of performing 10 the same may be properly understood I have hereunto appended a Sheet of explanatory Drawings to be herein-after referred to, and showing by way of example the application of my improved arrangements in connection with the furnaces of a steam boiler of a common type.

Figures 1 and 2 are respectively a longitudinal vertical section and a 15 transverse vertical section. The boiler 1 is a horizontal cylindrical one with two large flues 2, and internal furnaces 3, the front and door of one of the furnaces being supposed to be removed in Figure 2. Piping 4 of cast iron or fire-clay is placed in the flue 2 so as to be exposed to the fire gases when at their hottest, and air is made to traverse this piping and to 20 issue amongst and mingle with the fire gases just as they leave the furnace 3. The air is made to traverse the piping 4 in the flues by means of a fan 5 or other blowing apparatus, and when the furnace or the furnace and steam boiler or other apparatus or object heated by it are situated in a shed, building, or other enclosure, as shown in the 25 Drawings, so that the air over and about them is heated by radiation, the blowing apparatus 5 is arranged to take up such heated air and force it through the piping 4. The fan 5 is shown as driven by a belt 6 from a pulley on a revolving shaft 7 supposed to be part of the machinery driven by the engine supplied by the boiler 1, but it may in many cases 30 be more convenient to drive the fan or blowing apparatus by means of a small donkey engine.

One fan or piece of blowing apparatus may be used to supply air to two or more furnaces, each branch pipe 4 being fitted with a valve or damper 8 to regulate the supply by it. A double or broad bridge 9, 10, 35 is constructed at the back or inner end of each furnace 3, and the piping 4 leads the highly heated air into a space 11 formed in the lower part of this bridge. One or more narrow slits or openings 12 in the top



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of the bridge allow the air to issue from the space 11 below, and it mingles with the fire gases as they pass over the bridge and insures the thorough combustion of any incompletely burnt portions, the space over the bridge, and more particularly above the inner part 10, being contracted  
5 so as to compel a thorough intermingling of the heated air and gases. With these arrangements a sufficient quantity of thoroughly heated air can be blown in to suit any condition of the fire so as to reduce the production of smoke to a minimum, and so as to realise the economy in fuel to be expected from the perfected combustion of the constituents  
10 of the fuel. It has in practice been found sufficient to introduce into the flues the comparatively short extent of air piping shown in the case of steam boilers, such as the one shown, but the air piping may be made to traverse the flues to any desired extent, provided that it is finally led through the hottest flues prior to delivering the air at the  
15 bridge 9, 10.

Having thus particularly described my said Invention and the manner in which the same is to be performed, I have to state that I do not restrict myself to the precise details herein described or delineated, and that I do not claim every mode of using heated air for preventing smoke ;  
20 but that what I believe to be novel and original, and claim as the Invention secured to me by the herein-before in part recited Letters Patent is, the preventing or reducing of the production of smoke in furnaces by means of improved apparatus or arrangements substantially such as are herein-before described, and more particularly the placing of  
25 the air piping in the hottest parts of the flues.

In witness whereof, I, the said David Walker, have hereunto set my hand and seal, this Third day of November, in the year of our Lord One thousand eight hundred and seventy.

DAVID WALKER. (L.S.)

30 Witness,

WILLIAM WILSON,  
Swanfield Flour Mills,  
Leith.

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LONDON :

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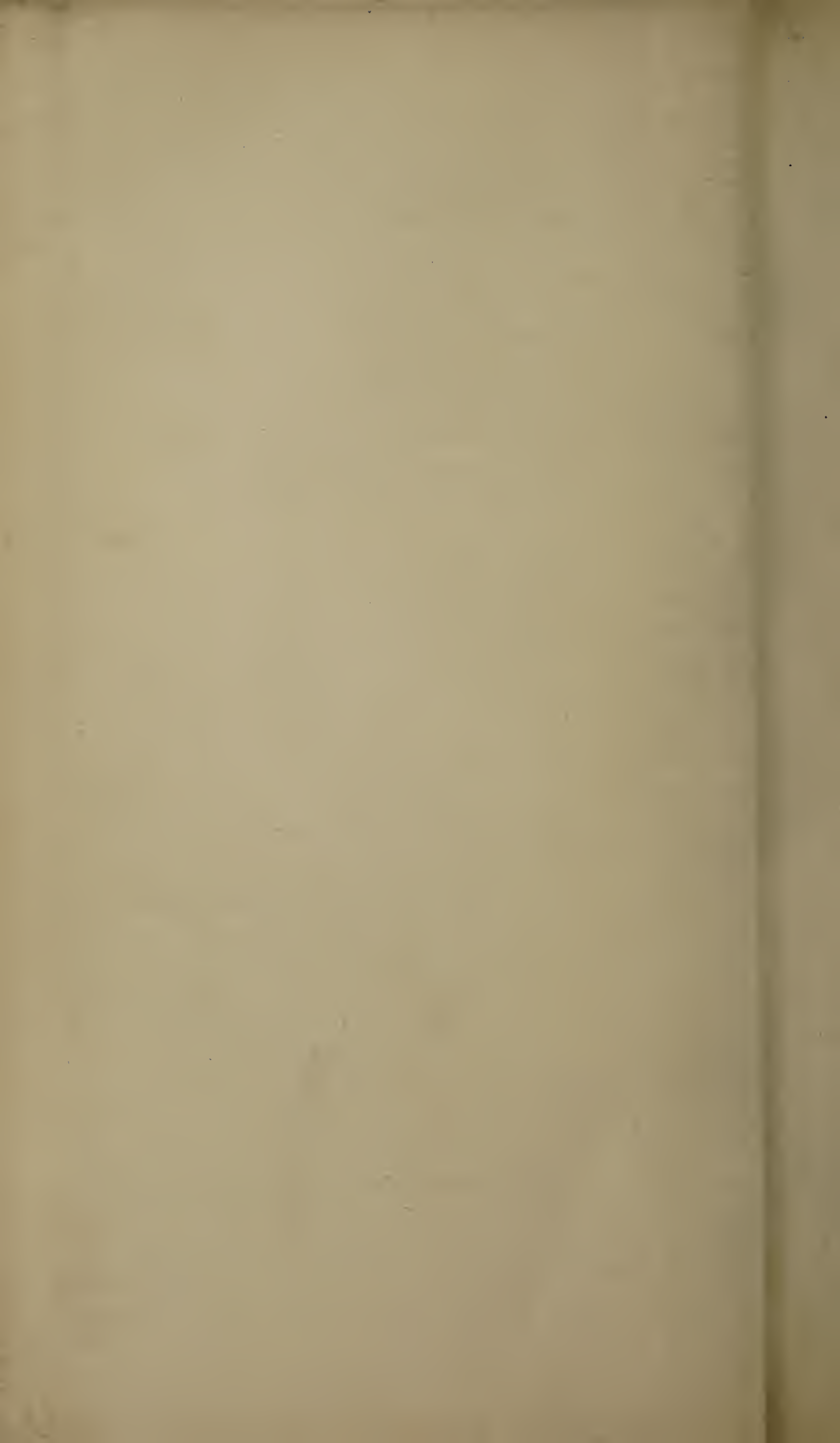




FIG. 1.

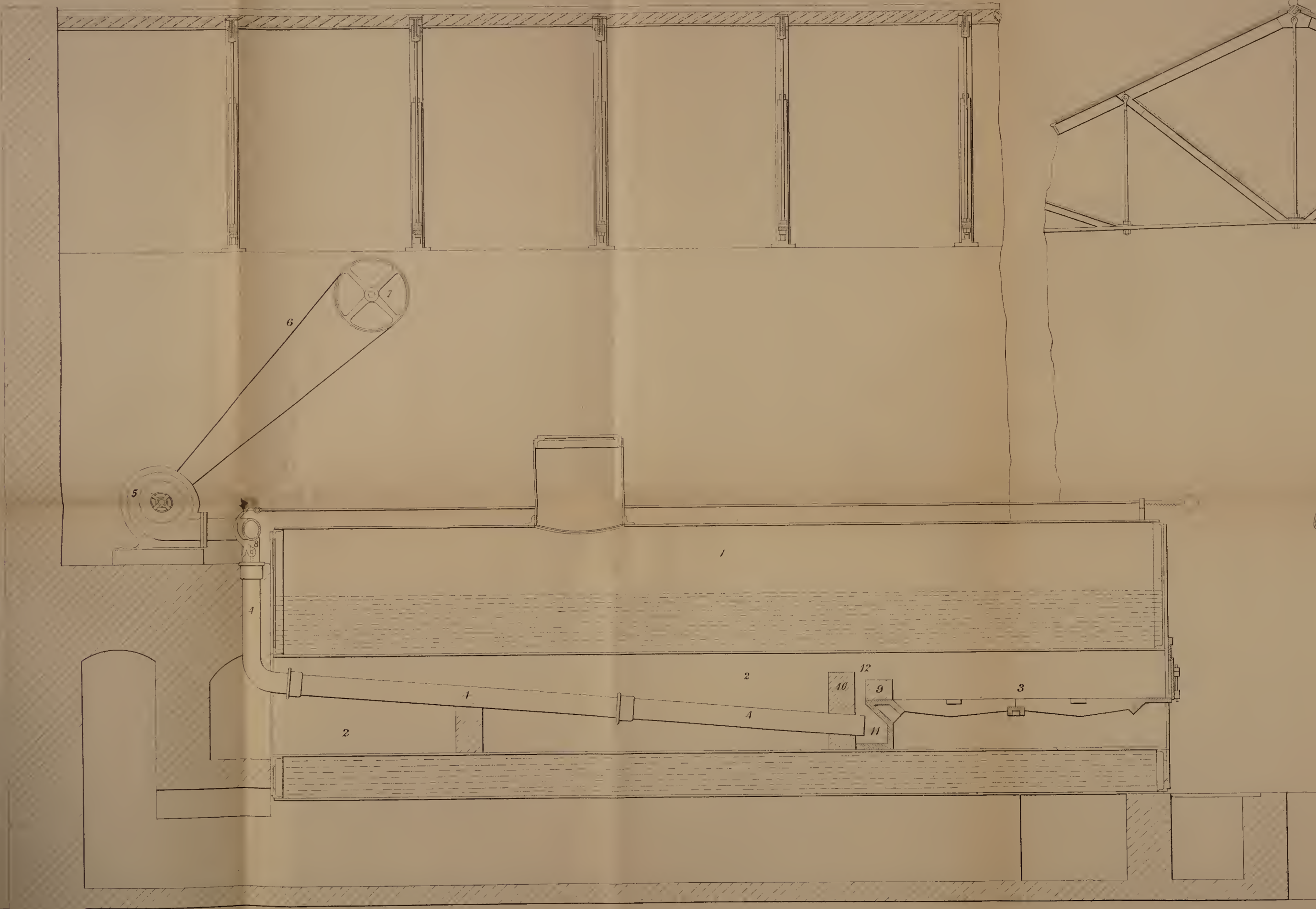
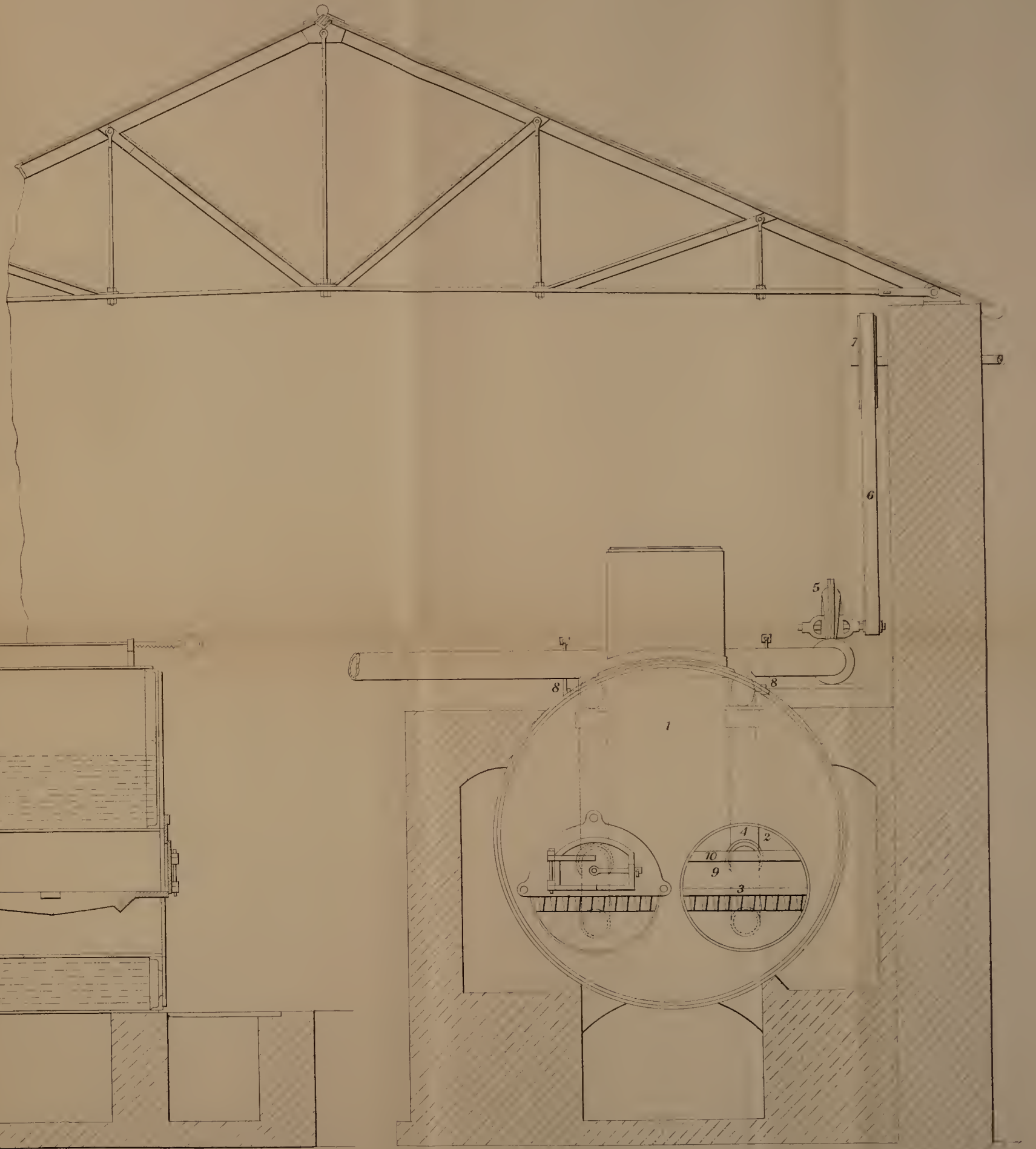


FIG. 2.



Scale

